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ABSTRACT

Some of the more frequently observed reflex patterns in cerebral palsy are examined, and descriptions are given of how they affect movement. A chart outlines: (1) desirable movement patterns; (2) typical abnormal movement of the cerebral palsied child; (3) possible physical cause of abnormal movements; and (4) activities which may facilitate movements closer to the norm. A list is also provided of typical areas of excess tone (arm flexors, leg adductors, lower limb extensors, and trunk flexors and extensors) and physical activities that should be avoided or minimized when the excess condition is present. A glossary of terms is included. (JD)

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JEANNE SHANKS SELLERS

HOW ABNORMAL REFLEXES INFLUENCE MOVEMENTS IN CEREBRAL PALSY

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All children are under the influence of reflexive movements at birth. As maturation occurs, the child learns to facilitate and inhibit these reflex patterns to produce volitional movements. When integration of reflexes does not occur or is delayed, normal motor development is lost or delayed. Neurologically involved children remain under the influence of reflexes and do not develop normal postural control, equilibrium and protective reactions normally.

The purpose of this presentation is to briefly examine some of the more frequently seen reflex patterns in cerebral palsy and how they affect movements. Suggested activities will be given to facilitate better movement patterns. Activities which should be used with caution for certain types of involvement will also be given.

The Asymmetrical Tonic Nect Reflex (ATNR) is present from birth and is integrated by age 4 to 6 months. Whenever the head is turned to one side, the arm and leg on the face side extend while the arm and leg on the skull side flex. Some refer to this as the "bow and arrow" or "fencing" positions.

The ATNR is usually stronger when the child is supine* or sitting and a stronger pattern is usually seen in the upper extremities when supine. Some children exhibit this only on one side of the body; however, it may be present bilaterally with

*See Glossary of Terms

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one side having a stronger pattern. When sitting, the child has difficulty maintaining balance as he tends to fall either toward the face side or backward. The child may sit with the head forward as this tends to inhibit the reflex. However, if the head is continually forward, the child will have difficulty looking up or fear he will fall backward.

Children with strong ATNR patterns also tend to develop scoliosis and subluxation or dislocation of the flexed leg. When sitting the hip of the flexed leg tends to pull upward causing asymmetry of the pelvis. Scoliosis usually is more prominent in children with a strong ATNR to one side.

When standing, diplegics* tend to extend one leg and flex the other; however, with the leg extended the child is unable to move. Athetoids* may bear weight on one leg and demonstrate a pawing action with the other leg.

The Tonic Labyrinthine Reflex (TLR) is stimulated by the head in relation to gravity. When the child is supine, extensor tone dominates and the limbs extend. When prone* the opposite occurs; flexor tone is dominate and the limbs flex. This reflex is present from birth to approximately 6 months.

When supine, the cerebral palsy child may retract the neck and shoulders, rigidly extend the back and adduct* the legs. It is difficult for the child to lift the limbs or head off the floor. Rolling is limited or impossible due to the inability to rotate the hips or shoulders. The child is also unable to bring the hands to midline to play. If the child attattempts to come to sitting from supine, the hips tend to extend.

Once upright, flexion patterns will predominate as the head moves forward. The child also has difficulty getting into and maintaining a quadruped* position because the arms cannot extend. This limits development of trunk extension.

The Symmetrical Tonic Neck Reflex (STNR) is also triggered by the position of the head as in the ATNR. When the head is raised or extended, the upper extremities extend and the lower extremities flex. When the head is lowered or flexed, the upper extremities flex and the lower extremities extend. For example, if a dog crawls under a fence, he lowers his head, flexes the front legs and raises the hind legs. When he comes to the opposite side, he raises his head, extends his front legs and flexes his hind legs.

The STNR appears at approximately 4 to 6 months, about the time the ATNR is integrated, and is integrated at approximately 8 to 12 months. Its purpose is to break up the dominate extensor pattern of the child and aid the child to come to hands and knees. However, the reflex must be integrated if the child is to develop reciprocal creeping*.

With continued influence of the STNR, the child has difficulty moving the legs reciprocally and will tend to pull both knees forward or "bunny hop". He also will sit on his heels and not develop good weight bearing into the shoulders or hips. Therefore, correct weight bearing on hands and knees is necessary to inhibit this reflex.

The Positive Supporting Reflex allows the child to bear weight on his legs when stood upright. It emerges at approximately 3 months is integrated by 8 months. Whenever pressure is applied to the ball of the foot, simultaneous contraction of flexors and extensors occurs in the lower extremities.

The Positive Supporting Reflex is seen in almost all spastic* cerebral palsy according to Bobath. In diplegics, the hips and knees are semiflexed when standing. The legs tend to adduct and internally rotate (scissoring). The child stands with the heels raised and the feet turned inward. The toes may also "claw" which further exaggerates extensor tone. Because of the adduction of the legs, there is a narrow base of support which makes balancing in standing difficult. These children have difficulty standing from a chair for pushing the feet against the floor evokes extension of the legs which causes him to push backward. When standing, the child cannot put the heels down; therefore, normal weight transfer in walking is impossible. With added weight on the ball of the foot, the reflex is continually stimulated.

If the primitive reflexes are not integrated into more complex movements the child will not develop equilibrium reactions that begin to emerge at approximately 7 months and remain throughout life. Protective reactions and equilibrium are those automatic movements used to control or maintain the body's centers of gravity. Protective extension reactions protect the

the body when balance is lost through horizontal or diagonal forces. The child will automatically reach out with the arms or legs to prevent falling when balance is lost in sitting or standing. However, in the severely involved spastic and those with hyperactive tonic neck reflexes, the movements of the limbs away from the body are impossible or too slow to prevent a fall. Protective reactions also do not develop in hemiplegics* and those with flexor spasticity of the upper extremities and trunk. For those who do develop some protective reactions, the direction in which they move is different according to the type of involvement. Spastics do better with forward protection while athetoids and ataxics* do better with sideward movements. Very few develop backward protection. The lack of development of forward protective reactions retards the development of support with extended arms when prone, sitting with arm support and attaining a quadruped positioin. Because of this lack of protective reaction, the child becomes very apprehensive about movements because he instinctively realizes that he will fall. To protect himself from such a possibility, the child tends to tighten his body and hold himself rigidly. This in turn prevents moving his body to accommodate unbalancing movements.

Righting Reactions have an important place in normal development. These reactions keep the head in normal vertical position, maintain symmetrical alignment of the head and trunk, and maintain body alignment when the head is turned. These reactions enable the child to turn to his side, roll over to

prone, lift the head, get on hands and knees, sit and eventually stand. Lack of development of these reactions retards the development of body rotation which is needed in most movements.

Table 1 presents suggested activities that can be used by the teacher to facilitate better movement patterns in cerebral palsy children. It must be remembered that a child learns movement by repetition. Repeated activities within a certain movement pattern reinforces that pattern for the cerebral palsied child. When hypertonia is present in certain muscles, repeated activities can contribute to increased tension; therefore, care should be taken to avoid activities which may learn to excessive increase of tension within already hypertonic* muscles. Table 2 gives a few activities which should be used with caution in certain types of hypertonia as their continues use may reinforce an already atypical pattern.

Two basic principles need to be incorporated into all activities for the cerebral palsied child - midline orientation and body symmetry. Many spastic and athetoid children have difficulty bringing the hands together in front of the body to play and manipulate objects, learn feeding techniques, or develop biocular vision. Any activity which promotes bringing the hands to midline is usually desirable. Body asymmetry is prevalent in almost all spastics and occasionally in athetoids with a strong ATNR. Careful assessment of an activity will aid the teacher in determining whether the activity is promoting asymmetry.

Carefully selected activities can facilitate desired movement patterns in cerebral palsied children. Observation of the child's habitual movement patterns will provide clues for the teacher in better planning of activities. Achieving good body alignment and stability will greatly improve the child's ability to perform activities in a more normal manner.

Table 1

ACTIVITIES TO FACILITATE NORMAL MOVEMENTS

Desired Pattern	Abnormal Pattern	Possible Cause	Facilitating Activities
Weight bearing on arms	Shoulders forward, arms flexed	Hypertonus of shoulder girdle	1. Prone on elbows or side sitting on one hand
Using arms and hands for activities	Inability to bear weight into shoulders	Lack of shoulder stability	2. Propping on one elbow or hand while using other hand in play
Fine motor control	Inaccuracy and poor control	Lack of shoulder stability; weak arms and hands	3. Wheelbarrow walking 4. Seal Walk 5. Crab Walk 6. Wall push-ups 7. Pushing heavy objects such as a weighted cart 8. Prone activities on scooter board
Reaching forward with arms, shoulder forward	Shoulders pulled back, arms flexed, inwardly rotated	Hypertonus of shoulder girdle; abnormal reflexes	1. Reaching for or pushing objects 2. Batting a suspended ball 3. Shuffleboard 4. Pushing away from wall 5. Breast stroke 6. Elementary back stroke

Desired Pattern	Abnormal Pattern	Possible Cause	Facilitating Activities
Sitting or standing straight, head balanced over shoulders	Sitting on sacrum, back rounded, head forward Standing with trunk flexed, knees and hips flexed Poor balance	Tight hamstrings; inadequate extensor tone or predominate flexor tone Abnormal Tone	1. Bear Walk with knees straight and feet on floor (for hamstrings and ankles) 2. Prone trunk extension 3. Activities done in prone 4. Scooter board activities in prone 5. Rocking board activities
Trunk rotation	Body moves as total unit Inability to twist, turn	Hypertonus of trunk Inability to segmentally separate body into parts	1. Seated, reach for objects placed on side of body 2. Any activity utilizing body rotation 3. Rolling segmentally (head, shoulders, trunk, pelvis, legs) 4. Supine, knees flexed to chest, roll legs from side to side 5. Bend, twist, turn activities
Adequate abdominal strength	Weak abdominals Poor pelvic positioning	Lack of normal movement to develop abdominals	1. Reverse sit-ups 2. Sitting astride barrel or large ball, hands behind head; move slowly from side to side 3. Supine on scooter board, head raised as pushed around area with feet

Desired Pattern	Abnormal Pattern	Possible Cause	Facilitating Activities
Balance	Static and dynamic instability	Pelvic instability Underdeveloped righting reactions Underdeveloped equilibrium reactions Tight hamstrings and/or heelcords Hypertonicity	1. Sequential developmental balance activities: hands and knees - knees - half-kneeling (foot and knee) - standing 2. Moving laterally with proper weight shift 3. Barrel or large ball activities to develop equilibrium 4. Trampoline activities 5. Rocking board activities in sequential patterns 6. Balance beam activities
Moving legs reciprocally	Legs move as unit, no separation of flexion and extension	Abnormal reflex patterns Hypertonus	1. Moving an object alternately with feet 2. Tricycles or other pedalled toys 3. Pushing alternately with feet on scooter board 4. Creeping (hands and knees) 5. Alternate flexion and extension of legs in supine
Protective and equilibrium reactions	Fall without protection of arms and legs Difficulty moving body to vertical when tilted	Hypertonicity Underdeveloped protective and equilibrium reactions	1. Over barrel or large ball, reach hands to floor when tipped forward 2. Sitting, move trunk sideward when moved laterally

Desired Pattern	Abnormal Pattern	Posible Cause	Facilitating Activities
			3. Trampoline 4. Rocking board activities 5. Sitting astride barrel-maintain balance as rocked from side to side 6. When kneeling, half-kneeling or standing, gently push from various directions

Table 2

ACTIVITIES TO USE CAUTIONSLY

Areas of Excess Tone	Activities to Avoid or Minimize
Arm flexors	Lifting weights Pulling activities
Leg adductors	Tandam walking (heel-toe) Balance beam Rope climbing Flutter kick
Leg and foot extensors	Jumping Trampoline Toe walking Flutter kick Hopping
Trunk flexors	Sit-ups Pulling activities
Trunk extensors	Trunk extension Push-ups Activities done in prone

GLOSSARY OF TERMS

Adduct - bringing the limbs toward the body; bringing the legs together

Ataxia - third most common form of cerebral palsy characterized by poor balance and coordination

Athetoid - the second most common form of cerebral palsy characterized by slow, irregular, worm-like purposeless movements

Creeping - moving on hands and knees

Diplegic - involvement of the entire body; however, involvement more pronounced in the lower extremities

Hemiplegic - involvement of one side of the body

Hypertonic - characterized by too much muscle tone

Prone - positioned face down

Quadruped - on hands and knees; creeping in quadruped

Spastic - most common form of cerebral palsy characterized by excessive muscle tone; movements labored and stiff

Supine - positioned on the back

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